UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015

COURSE NAME	:	NETWORK FLOW
COURSE CODE	:	BWA 31003
PROGRAMME	:	3 BWA
EXAMINATION DATE	:	JUNE 2015/ JULY 2015
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1   Find the shortest paths from all nodes to all other nodes for the graph given in **FIGURE 1** using Floyd-Warshall algorithm.
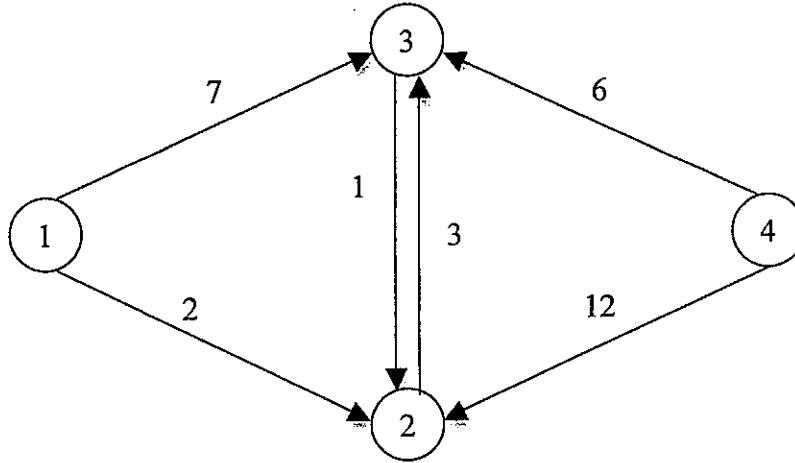
(10 marks)

FIGURE 1

Q2   A relief agency is urgently trying to get the maximum possible quantity of supplies from its base at A to the flood-ravaged city of F. One available route goes via B. The agency estimates that the A-to-B part of that route can carry 500 units per day, and the B-to-F segment, 320 units. A second route goes via C and D, with the A-to-C part having capacity 650 units, the C-to-D section, 470 units, and the D-to-F segment, 800 units. There is also a small mountain road with capacity 80 units that connects B to D. The third and fourth alternative routes via a small city E. They can go from A-to-E-to-B with the A-to-E part having capacity 400 units and E-to-B, 300 or A-to E-to-C where E-to-C part of that route can carry 400 units.

(a)   Formulate and solve this problem as a network problem. If you could increase the capacity of one of the road segment, which one will you choose? Explain.

(15 marks)

(b)   Formulate this problem as a linear programming problem. Do not solve.

(5 marks)

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Q3 Consider a project consisting of 10 activities. The estimated duration of the activities and the precedence relationship are given in Table 1 below.

Table 1

Activity	Predecessor	Time Estimate (weeks)		
		Optimistic	Most Likely	Pessimistic
A	-	1	3	5
B	-	2	3	4
C	-	3	4	5
D	A	2	9	10
E	C	4	5	6
F	B, D, E	5	6	13
G	A	2	4	6
H	C	2	4	9
I	G	5	7	9
J	G, H	3	8	13

(a) Draw the network diagram for this project and identify the critical activities by determining the slack value.

(15 marks)

(b) What is the probability that the project will be completed within 15 weeks assuming that the probability distribution of the project duration is a normal distribution?

(8 marks)

Q4 FI Chemical manufacturers use CC as the basic material for the production of CComplex. The ordering cost, holding cost per unit and the demand forecast of CC for the next 3 months by the management is given in Table 2 below.

Table 2

Month i	Demand D_i	Ordering Cost K_i (RM)	Holding Cost h_i (RM)
1	5	5	1
2	2	7	1
3	3	9	1

Due to limited space, the warehouse cannot carry more than 4 units of the basic material. The basic material is bought at the beginning of each month. The unit purchase cost is RM1 for the first 6 units and RM2 for additional units. The company wants to find an ordering policy for the next 3 months so as to minimize the total cost if the initial stock is 2 units and the final stock is required to be zero.

(a) Formulate the problem as a Dynamic Programming problem, stating clearly the stage, the alternative, the state and the recursive equation.

(5 marks)

(b)   Solve the problem using Dynamic Programming, and hence advise the company as to its optimal policy for the next three months.

(15 marks)

Q5   FA Industries, produces two products, X and Y. The company has a total of 24 production hours available. Each unit of product X requires 3 hours of production time and each unit of product Y requires 1 hour. The company will allow the use of overtime, but prefers to use at most 15 hours of production time. The company's marketing department has determined that it could sell at most 15 units of product X and at most 9 units of product Y. Since one of the company's goals is market penetration, the company will like to sell as close to the maximum sales of each product as possible. Each unit of product X generates a revenue of RM12 and each unit of product Y generates a revenue of RM9. The share-holders expect a net revenue of at least RM200.

(a)   Formulate the above multiple goal problem of determining the optimal quantity of products X and Y as a goal programming problem. Note that all the figures are for one working day.

(10 marks)

(b)   Write down the initial tableau of the simplex method for this problem.

(5 marks)

Q6   Consider the following pre-emptive goal programming model.

Minimize $P_1(d_2^+) + P_2(d_1^-) + P_3(d_3^-)$

subject to
$$x_1 + x_2 + d_1^- - d_1^+ = 10$$
$$2x_1 + 3x_2 + d_2^- - d_2^+ = 18$$
$$5x_1 + 2x_2 + d_3^- - d_3^+ = 30$$
$$x_1 \leq 10$$
$$x_2 \leq 9$$
$$x_1, x_2, d_1^-, d_1^+, d_2^-, d_2^+, d_3^-, d_3^+ \geq 0$$

(a)   Use the graphical goal programming procedure to solve the problem.

(10 marks)

(b)   Determine the solution if the second and third priority levels are interchanged.

(2 marks)

- **END OF QUESTION** -

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